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WATER DISTRIBUTION SYSTEMS HANDBOOK

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17.2.1 Indicators for Unaccounted-for Water

Unaccounted-for water is the difference between water produced by the utility (and usually measured at the treatment facility) and metered use (i.e., sales plus non-revenue producing metered water). Unaccounted-for water can be expressed in flow units [e.g., *millions gallons per day (mgd)*] but is usually discussed as a percentage of water production:

$$\text{Unaccounted-for water (\%)} = \frac{(\text{Production} - \text{metered use} \times 100\%)}{(\text{Production})} \qquad (17.1)$$

Although various groups have (e.g., AWWA M-36, 1996) proposed a consistent definition for unaccounted-for water, there are almost as many ways to calculate unaccounted-for water as there are individuals performing the calculation. For example, some utilities may subtract an estimate of water used for blowoffs and flushing from water production, whereas others may add blowoffs and flushing to metered use or include it as unaccounted-for. Some utilities include estimates of known, unrepaired leaks as accounted-for use. Because unaccounted-for water is used as an indicator of system performance, an universally agreed-on definition is not so important as long as comparisons made between utilities and, in a given utility over time, use the same definition.

Elimination of unaccounted-for water is a goal of all utilities, but it is impossible for utilities to reach this goal. A commonly accepted rule-of-thumb for acceptable levels of unaccounted-for water is 15 percent, although this value is highly site specific. The real rule for deciding whether unaccounted-for water exists at an acceptable level is an economic one; the economic savings in water production at least offsets the cost of reducing unaccounted-for water. For example, on a present-worth basis, the cost of a leak detection and repair program should be less than the value of water no longer leaked plus any damages associated with leaking water. In an area with costly treatment requirements and limited source capacity, it may be worthwhile to reduce unaccounted-for water to less than 10 percent. In a utility with excess capacity, little growth, and inexpensive treatment and pumping, unaccounted-for water exceeding 20 percent may be acceptable.

An unexpected increase in production at a well or water treatment plant can indicate that a new leak has occurred but has not yet been detected. If daily water production can be monitored for smaller zones within the distribution system, even better insights into the location of new leaks can be obtained.

17.2.2 Understanding the Causes of Unaccounted-for Water

To reduce unaccounted-for water, it is necessary to understand where this water is going (Hudson, 1978; Siedler, 1985; Wallace, 1987). It could be lost to leaks, theft, meter underregistration, authorized unmetered use, and flat-rate users. There are some rules of thumb, however, to help identify the primary cause (Siedler, 1982). Once the primary cause of large amounts of unaccounted-for water has been isolated, an effective program to reduce unaccounted-for water can be implemented.

Per capita water usage can be calculated using several formulas to shed some insight on the source of unaccounted-for water. The simplest definition of per capita use is

$$\text{Systemwide per capita use} = \frac{(\text{Water production})}{(\text{Population served})} \qquad (17.2)$$